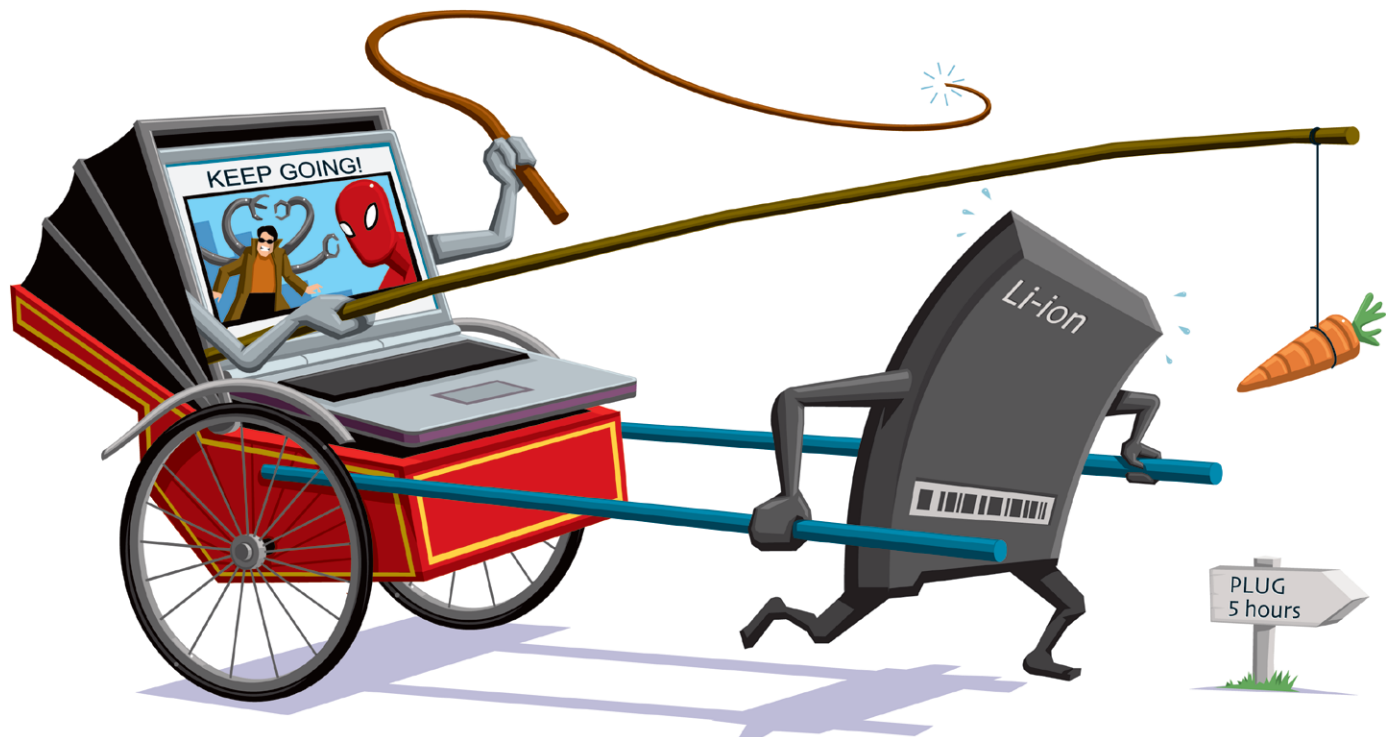




Get more from your Notebook Battery

Your notebook may give you freedom on your travels – but once the battery runs out, so does the freedom. However, there are ways you can reduce your chances of losing power on the move, as **David Fearon** explains

The limitations of notebook battery life can be a pain, although the situation's better than it used to be. Over the years, the running time you can expect on a single charge has crept up. With a Centrino laptop you can now get up to five hours, a huge improvement on the hour or two you could manage a few years ago. But batteries still need looking after, and there are things you can do both to improve the time you get out of them per charge and increase their overall lifespan.

Although we live in a super-accurate digital world, batteries are resolutely non-digital devices. A battery converts chemical energy into electrical energy. It is primarily designed and developed by chemists and is very much analogue in nature. Like most analogue devices, its performance can fluctuate and deteriorate over time.

All batteries work in basically the same way: they're filled with a chemical compound known as an electrolyte, combined with plates of a different material. When in contact with each other, the plates and electrolyte react to produce electrical charge and a voltage between the anode and cathode, which are the negative and positive electrodes of the battery. This is why batteries tend to have double-barrelled compound names such as lead-acid and nickel-cadmium.

MEMORY LOSS

When notebook computers started appearing in the late 1980s, they were powered by nickel-

cadmium (NiCd) batteries. NiCd technology has been around since the early 20th century. NiCd batteries have the advantage of being able to supply huge amounts of power if required and can be recharged up to 500 times. But they have one big drawback, known as the memory effect. If a NiCd battery isn't 'fully cycled' – completely drained before recharging again – it remembers the partially discharged state it was in before charging and subsequently refuses to deliver a full charge. This means less energy from the battery and shorter life between charges. Also, the cadmium used in NiCds is a toxic heavy metal that the world's landfills can really do without.

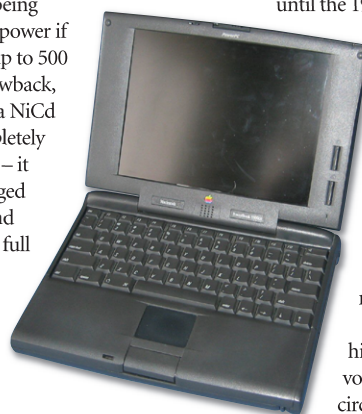
Then came nickel metal-hydride (NiMH), which did away with the cadmium and, along with it, some of the memory effect. NiMH cells tend to have a higher energy capacity for a given size, too, and can be recharged up to 1,000 times. The memory effect is still able to make its presence felt, though, unless the user is careful about fully charging and discharging now and then.

And so we come to the present day, and lithium-ion (li-ion) batteries. The basic technology has been around since the 1960s, but it was

enormously expensive. It was used only in such applications as the military and space missions until the 1990s. One problem for many years

stemmed from the fact that li-ion cells need far more carefully controlled charging and discharging than other types of cell. Fail to properly control li-ion cells, and they have a nasty habit of catching fire or exploding. This happened on several occasions to Apple's ill-fated Powerbook 5300 in the mid-1990s.

The solution was to embed highly sophisticated current and voltage-sensing and tracking circuitry into the batteries. Li-ion battery packs are invariably 'smart' and consequently expensive; that is, they were until recently, when the costs of the circuitry dropped and huge economies of scale kicked in.



▲ Apple's otherwise-competent Powerbook 5300 suffered from early-model lithium-ion batteries, some of which actually exploded

TIME LINE

The one thing you can guarantee is that a li-ion notebook battery will die eventually. From the time they are manufactured, they inevitably deteriorate. Even with the best care, you'll be lucky to get more than five years' use out of one. But if you follow some of the care tips here, you'll find you can as much as double a battery's lifespan.



• **Keep an eye on your processor** Many people don't realise that the more work your processor does, the more power it needs. If you have processes running in the background such as virus checkers, the processor will be occupied more of the time, which increases power consumption irrespective of your power-management settings. Consequently, make sure you don't install too much software willy-nilly that introduces lots of background tasks.

You can easily keep an eye on processor activity by right-clicking on an empty area of the Windows taskbar, selecting Task Manager and clicking the Performance tab. The box labelled CPU Usage gives you the current CPU load as a percentage, and the graph to its right gives you the history over the preceding few minutes. Click on the Options menu in Task Manager and select Hide When Minimized, and you can minimise the window to a System Tray icon that shows the CPU load at all times. If it seems to hover above a few per cent for an extended period, you've got an application running in the background that's draining your battery faster than necessary.

• **Use Windows XP's power management** If you've not already discovered it, the Windows XP Power Management applet can be found in the Control Panel. Just double-click on Power Options. Set the profile to Max Battery and Windows will use the most aggressive power-management settings it can.

• **Remove unnecessary components** Wireless LAN PC Cards can chew through a lot of power, so if you're on the road, pop the card out of its slot when you're not using it. The same goes for other PC Card devices. If you don't take them out, at least make sure they're switched off in software.

Bluetooth adaptors use less power due to their shorter range, so switching them off will have less effect. But switch off when you're not using them anyway, and you'll improve your security too.

• **Check the BIOS** Windows' Power Management applet can't do the best job if power management isn't fully enabled in hardware. Modern Intel-based notebooks with Mobile Pentium processors have SpeedStep technology to slow the processor and reduce its voltage when idle. It's worth checking the notebook's BIOS – by pressing F2 or Del during startup – to see if SpeedStep is enabled.

• **Turn down the lights** The fluorescent backlight of a notebook screen is one of the biggest power

Understanding battery capacity

All batteries, whether they are older technologies or the latest li-ion super-cells, have a certain capacity. This is usually expressed in milliamp-hours, or mAh. The mAh figure tells you how much current the battery can supply for one hour. So a 1,000mAh battery can nominally supply 1,000mA (one amp) for one hour before it is exhausted. It could supply 500mA for two hours, 250mA for four hours or 2,000mA for half an hour.

However, the current capacity by itself doesn't tell you everything. The total energy capacity of a battery also depends on its voltage. A 6V 1,000mAh battery holds half as much energy as a 12V 1,000mAh pack. To calculate the total energy capacity, multiply the current capacity by the voltage. So a 12V 1,500mAh battery has a total energy capacity of 18,000 milliwatt-hours (18,000mWh), which is the same

as 18 watt-hours (18Wh). Watts can also be written as volt-amps, or VA. The Wh or VAh figure is the best figure to use when comparing batteries.

You'll often see manufacturers offering three-, six- and nine-cell batteries for a notebook. This refers to the number of individual li-ion cells in a given battery pack. A three-cell battery pack has three individual li-ion cells in it. You can't individually control the voltage of a li-ion cell – it is a fixed chemical reaction, and gives around 3.3V to 3.7V per cell, depending on the particular chemistry. To get the required voltage, you need to wire them together in series sets of three; this gives you about 11V. A six-cell pack has the same output voltage, but the extra three cells are wired in parallel to double the current capacity, and hence double the amount of energy in the battery. A nine-cell pack is the same, but triples the total capacity over a three-cell pack.

drains. Whenever you can, reduce the brightness so you can eke more life out of the battery. Windows' power management does this for you after a certain period of inactivity. If that irritates you, get into the habit of using your notebook's keyboard shortcut to dim the brightness when you're having a break.

• **Beware of strange potions** In *What's New, Shopper* July 2005, we looked at the BatteryLife Notebook Activator. This is a strip of foil-like adhesive stuff that claims to rejuvenate older batteries when slapped in the side. Our tests showed no improvement. You should treat these seemingly magic devices with caution.

SERVICE CHARGE

Unlike older NiCd and NiMH batteries, li-ion cells are very tolerant of being partially discharged and recharged. You can top up the charge of a li-ion cell without any permanent negative effect on the cell itself.

One thing that does reduce their life, however, is being continually kept in a 100 per cent charged state. Unfortunately, this is exactly what happens if you mainly use your notebook as a desktop replacement and leave it plugged into the mains all the time. Li-ion batteries can't handle this. When you want to take the notebook on the road after

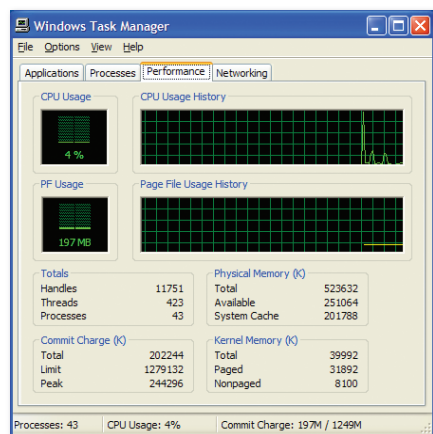
several months of being plugged in all the time, you'll find the capacity has been severely reduced.

It's easy to cope with this, though; just pull the mains adaptor's plug out of the back of the notebook at least once a month – you can do this when the notebook is switched on with no ill effects. The battery will immediately kick in. Carry on using the notebook as usual, and when the charge level has reached about 40 per cent, simply pop the mains adaptor back in again.

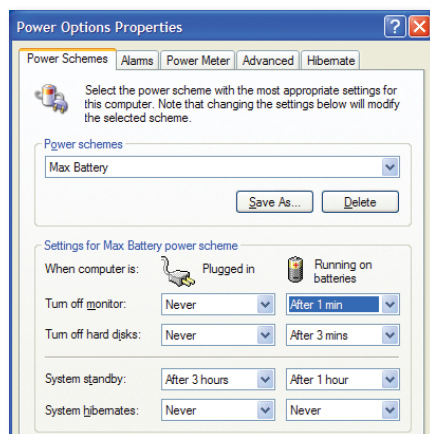
The other option is to remove the battery completely, but you should check your notebook's manual as some are designed to be used with the battery in place. If you remove the battery, it's very important not to store it fully charged. Use it until the charge level is between 40 and 50 per cent, and then take it out. This will slow down the deterioration process dramatically. You should keep it somewhere cool, too, as the battery's ageing process is accelerated in hot conditions. You can even put it in the fridge – but not the freezer!

The fact that li-ion batteries can be affected by the notebook being constantly plugged in has led certain manufacturers to include a plugged-in power management mode that uses the battery rather than the main supply some of the time. This gives a constant partial-discharge/charge cycle that keeps the battery in the best condition. If your notebook has this feature, make sure you use it.

You will also find a battery recalibration or conditioning routine in the BIOS setup of many notebooks. As we've seen, li-ion batteries don't need to be fully discharged and recharged to stay in good order. However, the smart electronics in them – which keep track of how much charge has gone into and come out of the battery, and let Windows give you a percentage figure of charge remaining – can become inaccurate over time. So even when the li-ion cells are in good condition, the smart part of the battery pack prematurely reports that they are fully charged and stops the charging process to protect them. The upshot is apparent reduced battery life even though the cells are fine; they're just not being fully charged. To correct this, the reconditioning routine runs the cells flat and completely recharges them so the smart electronics can get their bearings and recalibrate. **CS**



▲ Keep an eye on your processor usage using the Windows Task Manager



▲ Windows' Power Options is the starting point for maximising battery life